REMARKS

First and second preliminary amendments were filed on October 22, 2003 and November 19, 2003. Claims 1-25 are in the case and rejected. Claims 2, 3 and 16 are not rejected on the basis of prior art.

Rejection of Claims under 35 U.S.C. 112

Claims 2-3 and 16 were rejected under 35 U.S.C. 112 first paragraph as failing to comply with the enablement requirement on the basis that the subject matter of claims 2 and 3 was not adequately described in the Specification.

It is respectfully submitted that the subject matter of claims 2 and 3 is fully described in the Specification at least at paragraphs 28 and 29.

The subject matter of claim 2 is fully described at least at paragraph 28 wherein it is stated:

> "It is preferred for an aperture angle of the transmitted light beam to be selected such that a width of the transmitted light beam in a pre-determined direction orthogonal to the transmitted light path directly in front of the restriction device is larger by a factor of 10 than a corresponding width of the received light beam directly at the restriction device."

In order to further enhance clarity and use of the present specification as a teaching tool for those skilled and unskilled in the art, further explanatory Figures 2A and 2B are enlargements of portions of Figure 2 with the exact same reference numerals as in Figure 2. In addition, the aforesaid "width of the transmitted light beam is designated as **a** and the "width of the received light beam" is designated as **b**. Therefore, it is further understood with respect to Figure 2A that a > 10x b.

With regard to Claim 3, it is respectfully submitted that paragraph 29 provides adequate description of the invention as defined in Claim 3, since paragraph 29 states:

> "It is therefore preferred for an aperture angle of the transmitted light beam to be selected such that a width of the transmitted light beam directly at the restriction device is larger in a pre-determined direction orthogonal to the transmitted light path than a mean movement amplitude of the transmitted light beam to be expected caused by a relative movement of the light transmitter and the restriction direction directly at the restriction device."

Referring to Figure 2B, reference numerals are as in original Figure 2 and the designation **M'** shows the center line of the divergent light beam 50 when not tilted and 50' shows the broader lines of the divergent light beam when the transmitter 42 is slightly shifted. Further referring to Figure 2B, M shows the center line of the divergent light beam 50 and M' shows the center line of the divergent light beam 50' when the transmitter 42 is slightly tilted. The main amplitude to be expected for this shift is designated as **c** and in accordance with the specification at paragraph 29, width **a** is larger than a mean movement amplitude of the transmitted light beam designated as **c**.

Although not acquiescing to the correctness of the rejection of Claim 16, Claim 16 has been herewith cancelled only to facilitate issuance of allowable subject matter.

Based on the aforesaid further clarification as a teaching tool for those skilled and unskilled in the art, it is respectfully requested that the rejection under 35 U.S.C. §112 be withdrawn as to claims 2 and 3.

OVERVIEW OF THE INVENTION

Before further addressing the subject matter of the present specification, the art and the claims related thereto, an overview of the essential teachings of the present application is thought to be helpful.

The present invention relates to a protective apparatus according to claim 1 to be secured to a component movable along a track B and for the monitoring of a protected zone 62 moving with said component 32. Further, the invention relates to an apparatus comprising such protective apparatus (claim 19), and a method for the monitoring of a protected zone (claim 23).

The present invention overcomes difficulties of prior art machines as illustrated in Figure 1 of the present invention. Prior art machines have components moved automatically by a drive device or are autonomously moved. If persons are standing in the movement zone of components, such persons can be potentially at risk from the movement of the component. Thus, protective apparatuses are arranged so that if the presence of the person is detected along a protected zone, the movement of the component can be disrupted. However, the disruption causes interruption of the bending tool which then can give rise to defective parts.

It is problematic that the machines of the prior art in practice are subject to vibrations of holding arms 16 and 18 as in Figure 1 whereby even without the presence of a body part between bending tool and work piece 14, the transmitted light beam from 27 is no longer received by light receiver 22 even without the presence of a body part. Thus, the evaluating optics detect an interruption in the light path and the machine being stopped unnecessarily.

In contrast to prior art machines as in Figure 1, the present invention provides for a restricting device 52 (Figure 2) arranged in the direction of the transmitted light path after the light path has passed the protected zone. Thus, the light beam transmitted from transmitter 42 (Figure 2) of the present invention is divergent and it does not define the protected zone, but only contains it. Thus, the present invention provides an ability to protect persons potentially at risk from movement of components of the machine while at the same time avoiding unnecessary downtime. Hence, the present invention has an improved tolerance against tiltings and shiftings, for example, due to vibrations.

More specifically, component 32 together with light transmitter 42 moves in direction of arrow B upwards and downwards. According to the invention, light transmitter 42 emits a divergent light beam 50, the boarder-lines of which are given as dashed lines. The divergence is indicated as angle α. Further, the protective apparatus comprises light receiver 44 for the reception of at least some of the light of the transmitted light beam.

For example, vibration of the light transmitter 42 itself or the receiver 44 causes a relative tilt or shift of these elements. In the example of a relative tilt, this results in a tilted light beam 50', the boarder-lines of which are shown in short-dashed lines.

The invention provides for a restricting device 52 arranged in the direction of the transmitted light path after the light path passed the protected zone and serving to restrict the transmitted light beam to a less divergent received light beam 58, thereby determining the width of the protected zone 62 in at least one direction.

For example, the restricting device can be an aperture 52 as in Figure 2 or a reflective element 68, see Figure 3.

Contrary to the prior art disclosed for example in Figure 1, the light beam transmitted from transmitter 42 (Figure 2) is divergent. It does not define the protected zone, but only contains it. The protected zone 62 itself is defined with the help of the restricting device defining the part of the transmitted light beam to be used for detection. Thus, only the blocking of the part of the transmitted beam is effective as the protected zone is monitored.

As can be seen for example in Figure 2, tilting of the light transmitter 42 does not have an effect on the shape of the protected zone 62.

Hence, the inventive system has improved tolerance against tiltings and shiftings, for example, due to vibrations.

More specifically, Figures 2A and 2B show an enlarged portion of Figure 2.

Reference numerals 50 give the boarder-lines of the divergent light beam emitted by transmitter 42 without being shifted or tilted. The width of light beam 50 at the location of aperture 52 is called **a**.

Aperture 52 restricts the light beam which is received by light receiver 44. This part of the light beam defines protected zone 62. The width of the thus restricted received light beam at the location of the restricting device is called **b**.

Figure 2A shows a special embodiment in line with claim 2 in which **a** is larger than **b** by a factor of 10.

Figure 2B shows relations between the divergent light beam 50 without tilt or shift and divergent light beam 50' resulting from a tilt as shown in Figure 2. For clarity reasons, Figure 2B shows reference numerals naming features as in the specification. Again, 50 indicates the boarder-lines of the divergent light beam without tilt. For explanatory purposes, Figure 2B contains line M showing the center line of divergent light beam 50 when not tilted. 50' shows the boarder-lines of the divergent light beam when the transmitter 42 is slightly shifted. Further, M' shows the center line of divergent light beam 50', when the transmitter 42 is slightly tilted.

As also in Figure 2A, **a** denotes the width of the divergent light beam 50 at the location of the restricting device 52. Tilting or shifting the transmitter results in a shift of the center line at the location of the restricting device 52. The mean amplitude to be expected for this shift is called **c**. In accordance with the special embodiment to which claim 3 is directed, **a** is larger than **c**.

One can appreciate the advantage of the aforesaid system as further described in paragraphs 19-29 and 59-70 of the present specification.

REJECTION UNDER 35 U.S.C. §102(a)

Claims 1, 4-13, 17-23 are rejected under 35 U.S.C. 102(a) as being anticipated by Plasberg et al. EP 10246148 A2.

Claims 1, 19 and 23 are rejected under 102a for anticipation by Plasberg essentially on the basis that Plasberg shows a protective apparatus comprising a light transmitter 6 and a light receiver 3 and a restriction device in the path of a transmitted light beam which contains the protective zone.

The arrangement of the Plasberg apparatus and the function of the Plasberg apparatus are strikingly different from the present invention.

The Examiner in his rejection of the independent claims relies on Plasberg et al. (EP 10246148A) being an application of the assignee of the present application.

Plasberg '148 (see, for example, Figure 3) describes a protective apparatus comprising a light source 6, a reflective element 1 and a detector 3. The light beam reflected from reflective element 1 is focused with the help of convex lens 4. An aperture 10 is provided at the location of the focus point. According to paragraph [0023] of Plasberg, changing of the aperture diameter serves to change the focus depth of the system while keeping focus length constant. Due to increased focus depth, the specific requirements and tolerance for positioning the light receiver are much lower.

Plasberg provides for a detector 3 having spatial resolution (see, for example, claim 1). Shifting or tilting of the transmitter or the reflecting element results in a change of the pattern received by the detector 3, see Plasberg, paragraph [0029]. Therefore, tolerance against movements of the transmitter with respect to the receiver is achieved with the help of said detector having a certain lateral dimension to attempt to compensate for receiver and reflecting element movement with respect to each other. However, this Plasberg configuration requires an enlarged detector surface to attempt to arrange for the light being received at detector 3.

According to [0007] of the present application, however, an enlarged surface of the detector is disadvantageous and shall be avoided for the reasons given earlier above in the Overview.

As the aperture 10 of Plasberg is located at the focus point, it cannot serve to restrict a divergent light beam to a less divergent received light beam as claimed in the last paragraph of claim 1 of the present application. This is further clear from the fact that aperture 10 is not located in a part of the light beam being divergent.

It is not correct to construe the reflective element 1 of Plasberg as being a restricting element in the sense of present claim 1. In accordance with Plasberg, the protected zone is defined by section S. Specifically, the light path shown in Figure 3 of Plasberg between light source 6 and reflective element 1 does not contain the entire protection zone. Hence, reflective element 1 of Plasberg, Figure 3 is not arranged after a section of the transmitted light path containing the protected zone.

Further, with respect to the embodiments of Figures 2 and 4 of Plasberg, it is apparent that reflective element 1 does not provide any restriction of the light path.

From these considerations, it is clear that reflective element 1 of Plasberg cannot fulfill the object of a restriction element as claimed in present claim 1. Plasberg's reflective element only serves to re-direct the light beam of light source 6 to the detecting element.

Thus, Plasberg does not show, teach or suggest the arrangement of present independent claims 1, 19 and 23 and claims that depend therefrom. The same holds true for the remaining independent claims.

For the reasons given above, dependent claims 4-13, 17, 18 and 20-22 are not anticipated by Plasberg.

REJECTION OF CLAIMS UNDER 35 U.S.C. §103(a)

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Plasberg et al. EP 10246148 A2.

Claim 14 is submitted to be patentable over Plasberg for the reasons given with respect to Claim 1 from which it depends.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Plasberg et al. EP 10246148 A2 in view of Dalton et al. US 2003/0010137.

Dalton et al. is directed to a system and method for measuring torque. Therefore, Dalton is a completely different system. Dalton is not combinable with Plasberg to arrive at the present invention. Further, Dalton does not provide the deficiencies of Plasberg.

DRAWINGS

The drawings stand objected to for certain informalities. Applicants have attached drawing sheets 5 and 6 containing Figures 2A and 2B pursuant to the Examiner's suggestion and for the Examiner's approval.

SPECIFICATION

The specification has been amended only to add reference to Figures 2A and 2B according to the Examiner's suggestions and to correct obvious typographical errors.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

Dated: 24 March 05

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AMENDMENTS TO THE DRAWINGS

The attached added sheets of drawings include Figures 2A and 2B as requested by the Examiner to show features already described in the specification at paragraphs 28 and 29. Sheets 1/4, 2/4, 3/4 and 4/4 remain the same.

Attachment: Replacement Sheets: Figure 2A, Sheet 5; and Figure 2B, Sheet 6.